



Ontology portal for astronomy, planetary Sciences and heliophysics, *towards semantic interoperability*

Cecconi, B (1), Jonquet, C (2), David, E (1), Fretel, L (1), Debisschop, L (1), Bourrouche, I (2), Aicardi, S (1)

(1) *Observatoire de Paris-PSL, Paris & Meudon, France*

(2) *INRAE, Montpellier, France*

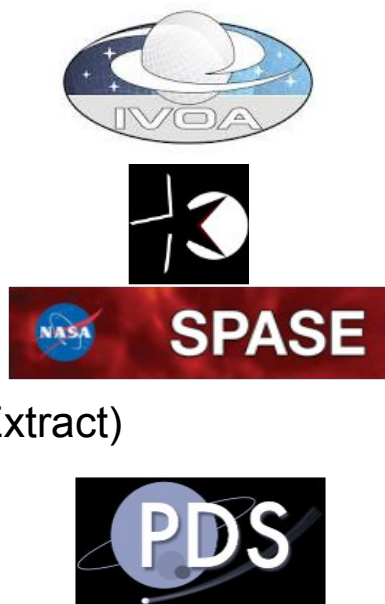
FAIR-IMPACT – EU funded project (Grant agreement: 101057344) <http://fair-impact.eu>

OPAL – Funded by OSCARS, an EU funded project (Grant agreement: 101129751) <https://oscars-project.eu>

OntoPortal-Astro

<https://ontoportal-astro.eu>

- **Goal:** gathering semantic artefact catalogues from astronomy, heliophysics, planetary sciences
- **Sources:**
 - **IVOA:** <http://ivoa.net/rdf>
 - **UAT** (Unified Astronomy Thesaurus)
 - **SPASE** (Space Physics Archive Search and Extract)
 - **PDS4** Information model
 - etc.



The screenshot shows the OntoPortal-Astro website. The top navigation bar includes links for 'Parcourir', 'Alignements', 'Recommandeur', 'Annotateur', 'Panorama', and a search bar. Below the navigation bar, there's a section for 'Filtres' (Filters) with options to show private ontologies, views, and retrieved ontologies. The main content area displays a list of ontologies, including 'UMLS Semantic Network (STY)' and 'Unified Astronomy Thesaurus (UAT)'. A detailed view of the 'UAT' ontology is shown, including its description, FAIR score, and submission information. The bottom part of the screenshot shows a full-length paper titled 'OntoPortal-Astro, a semantic artefact catalogue for astronomy' by Baptiste Cecconi et al., published in 'Astronomy and Computing'.

new version now online !

For more details: Cecconi et al. (2025) Astronomy & Computing, <https://doi.org/10.1016/j.ascom.2025.100991>

OPAL - Ontology Portal for Astronomy Linked-data

- **Advisory and User Group (AUG)**

A. Raugh (PDS, planets), J. Bartlett (UAT+ADS, astro), S Derrière (CDS, astro), V Delouille (ROB, helio), B Seignovert (Nantes, planets), R McGranaghram (JPL, helio), R Krah (Helmholtz, synchrotron), E Henley (MetOffice, space weather)

First meeting (online) was on Sept 25th 2025

- **2 ontologists in the team:** Elsa David, Liza Fretel.
- **New version** (developed by INRAE, France) include:
 - ontology FAIR evaluation
 - recommender / annotator
 - browse ontologies and mappings
 - advanced APIs (e.g., API search within ontology)
- **Connected with the OntoPortal Alliance** (led by Stanford).
 - Alliance meeting in Berlin (Sept 29th - Oct 3rd 2025).



Tool for vocabularies management

- **Vocbench**: a web-based, multilingual, collaborative development platform for managing OWL ontologies, SKOS(/XL) thesauri, Ontolex-lemon lexicons and generic RDF datasets.
- Installed for Paris Observatory
- Next, access may be opened for collaboration
- A connection with OntoPortal-Astro is planned : to enhance workflows between VocBench and OntoPortal, such as importing ontologies, aligning mappings, automating term proposals.

ClassConceptSchemeCollectionPropertyDatatype

Calibrated data (en)

Partially calibrated data (en)

Derived data generic (en)

Ancillary data (en)

Derived Reformatted data (en)

Edited data (en)

Partially calibrated data (en)

Raw data (en)

Current project: Processing-level Global Data Management About VocBench en

VocBenchProjectsDataMetadataSPARQLHistoryValidationTools

Create

Name	Open/Close	Accessed	Model	Lexicalization	History	Validation	Repository Location	Actions
Hapi_Ontology		☐	OWL	RDFS	✓	✓	local	▾
Processing-level		☒	SKOS	SKOS	✓	✓	local	▾
Reframe_skos		☐	SKOS	SKOS	✓	✓	local	▾
small-bodies_dynamical-class_V2		☐	SKOS	SKOS	✓	✓	local	▾
UAT_v2		☐	SKOS	SKOS	✓	✓	local	▾
UCD_v2		☐	SKOS	SKOS	✓	✓	local	▾

Current project: Processing-level Global Data Management

VocBenchProjectsDataMetadataSPARQLHistory

Unnamed query * + ▾

☐ Fetch prefix from prefix.cc

1 ▸ PREFIX ↔

11

12 ▾ SELECT * WHERE {

13 ?s ?p ?o .

14 } LIMIT 10

Current project: Processing-level Global Data Management About VocBench

VocBenchProjectsDataMetadataSPARQLHistoryValidationTools

ClassConceptSchemeCollectionPropertyDatatype

Partially calibrated data (en) x +

← → ↺ ↻ http://www.ivoa.net/rdf/processing-level# Partially_calibrated_data Rename A 🔍 ⚙️

Types:

rdf:type

skos:Concept

Top concept of:

Schemes:

skos:inScheme

Processing-level concept scheme (en)

Broaders:

skos:broader

Calibrated data (en)

Edited data (en)

Lexicalizations:

skos:prefLabel

ResViewTermViewCode

ClassConceptSchemeCollectionPropertyDatatype

Partially calibrated data (en)

Derived data generic (en)

Ancillary data (en)

Derived Reformatted data (en)

Edited data (en)

Partially calibrated data (en)

Raw data (en)

Search 🔍 .a. ⚙️

Currently working on...

- **ObsFacility** (Liza)
 - Observation Facilities (= observation platforms)
 - cross-matching of existing list of terms.
 - if id-matching and name/acronym matching not enough
=> we are testing LLMs [Fretel et al. 2025]
 - Goal: list of terms (with synonyms and meronyms) and name resolver
- **RefFrame** (Elsa)
 - Reference / Coordinate Frame vocabulary
 - work with NASA/Heliophysics team
 - to be merged with IVOA RefFrame vocabulary

Currently working on...

- **ProcessingLevel** (Elsa):
 - many lists of terms => propose vocabulary covering all cases, and listing the labels used in the various contexts.
- **UAT (Unified Astronomy Thesaurus)** extension for heliophysics (Elsa):
 - led by Ryan McGranaghham (NASA/Heliophysics).
 - reorganised hierarchy in UAT for heliophysics terms
 - new terms for heliophysics regions, new top level concept (Heliophysics)
=> should be in the next release (6.0, ~January 2026)



ontoportal-astro.eu API

- Allows opensearch query in a selected ontology.
- Example :
(search for *solar* in the IVOA UAT)

```
ontportal-astro-api.ipynb × +
```

```
[1]: import requests

[2]: apikey = '██████████'

[4]: word = "solar"

[6]: query = f"https://data-ontoportal.obspm.fr/search?ontologies=IVOA_UAT&q={word}&apikey={apikey}"

[7]: response = requests.get(query)

[14]: data = response.json()

[17]: print(f"Found {data['totalCount']} terms :")
      for item in data['collection']:
          print(f"- {item['prefLabel']} => {item['@id']}")

Found 113 terms :
- Solar abundances => http://www.ivoa.net/rdf/uat#solar-abundances
- Solar activity => http://www.ivoa.net/rdf/uat#solar-activity
- Solar analogs => http://www.ivoa.net/rdf/uat#solar-analogs
- Solar atmosphere => http://www.ivoa.net/rdf/uat#solar-atmosphere
- Solar chromosphere => http://www.ivoa.net/rdf/uat#solar-chromosphere
- Solar constant => http://www.ivoa.net/rdf/uat#solar-constant
- Solar core => http://www.ivoa.net/rdf/uat#solar-core
- Solar corona => http://www.ivoa.net/rdf/uat#solar-corona
- Solar cycle => http://www.ivoa.net/rdf/uat#solar-cycle
- Solar dynamo => http://www.ivoa.net/rdf/uat#solar-dynamo
- Solar eclipses => http://www.ivoa.net/rdf/uat#solar-eclipses
- Solar evolution => http://www.ivoa.net/rdf/uat#solar-evolution
- Solar faculae => http://www.ivoa.net/rdf/uat#solar-faculae
- Solar fibrils => http://www.ivoa.net/rdf/uat#solar-fibrils
- Solar filaments => http://www.ivoa.net/rdf/uat#solar-filaments
- Solar flares => http://www.ivoa.net/rdf/uat#solar-flares
- Solar granulation => http://www.ivoa.net/rdf/uat#solar-granulation
- Solar granules => http://www.ivoa.net/rdf/uat#solar-granules
- Solar instruments => http://www.ivoa.net/rdf/uat#solar-instruments
- Solar interior => http://www.ivoa.net/rdf/uat#solar-interior
- Solar macrospicules => http://www.ivoa.net/rdf/uat#solar-macrospicules
- Solar magnetism => http://www.ivoa.net/rdf/uat#solar-magnetism
- Solar mass => http://www.ivoa.net/rdf/uat#solar-mass
- Solar motion => http://www.ivoa.net/rdf/uat#solar-motion
- Solar mottles => http://www.ivoa.net/rdf/uat#solar-mottles
- Solar nebulae => http://www.ivoa.net/rdf/uat#solar-nebulae
- Solar neighborhood => http://www.ivoa.net/rdf/uat#solar-neighborhood
- Solar neutrinos => http://www.ivoa.net/rdf/uat#solar-neutrinos
```



Feedback

- Question from our **Advisory and User Group** (1st meeting in sept. 25):

About User contributed *mappings* and *notes*.

OntoPortal is a portal, not a repository.

Semantic artefacts are curated and maintained outside OntoPortal.

How to feedback to ontology curator team ?
(without duplicating reporting system, which often already exist).

Notes => open GitHub issues in relevant repository ?

Feedback

- **We are building semantic artefacts** (e.g., the ObsFacility vocabulary) with:
 - many altLabels from various sources
 - entity matching, using semantic scores (and/or LLMs)
- **We would like to keep track of this metadata**
 - => justification, provenance, verification, acknowledgement of sources
- Many sources are not available as machine readable semantic artefacts (and are not meant to be).
- How to store this additional metadata?
 - 2 ontologies: 1 with detailed tracking + 1 for day-to-day use?
 - specific schema? (SSSOM ? provenance? SKOS-XL?)
- How this would show up in OntoPortal?

Current limitations and findings

- Some IVOA vocabularies are Property vocabularies.
 - The OWL-API engine parsing the ontologies doesn't handle these nicely.
 - => need to update OntoPortal to support our use case.
- Some IVOA vocabularies are SKOS vocabularies
 - we don't always have a « ConceptScheme » (only IVOA-UAT has)
 - This is needed for generic ontology management
 - => update of *Vocabularies in the VO* to be prepared.

New vocabularies to be prepared

- Work with IHDEA to produce **SPASE RDF schema/ontology**
- Work with IPDA to produce **PDS4 RDF schema/ontology**
- Work with VAMDC (**virtual atomic and molecular data center**) to produce an ontology from their vocabulary
- Ontology for **Instrument-types** ?
(based on PDS4 information model and archive content)
- Vocabulary for **Instruments** (mounted on ObsFacilities): PDS4 context products; SPASE instruments, NSSDC instruments...
- Start building domain ontologies, e.g., **Small bodies**



Next steps

- Propose new mappings using OntoPortal.
- Implementation of FAIR practices in vocabularies
 - e.g., attribution, provenance, versioning, licence...
- Update practices to include each term's provenance in ontology
- Identify related semantic artefacts in other portals (e.g., in EarthPortal: GEMET, SOSA...)
- Work with astronomy data alliance to produce semantic artefacts from their XML schema.



Next OntoPortal Alliance meeting

- It will be in Paris, next fall.
- Let us know if you are interested to participate.

